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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/360,582	07/26/1999	BRANDON W. BLACKBURN	MIT-8312	4382

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EXAMINER	
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ART UNIT	PAPER NUMBER
3663	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/360,582	BLACKBURN, BRANDON W.	
	Examiner	**Art Unit**	
	JOHANNES P. MONDT	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 August 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4,5,7 and 8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4,5,7 and 8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office action is in response to the Reply filed August 11, 2010, under 37 C.F.R. 1.111 to the Office action mailed May 12, 2010. For Comments on Remarks filed with said Reply see below under "Response to Arguments".

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. ***Claims 1, 4, 5, 7 and 8*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Blackburn et al ("Development of a High-Power, Water-Cooled Beryllium Target for the Production of Neutrons in a High-Current Tandem Accelerator", CP392 in "Application of Accelerators in Research and Industry", pp. 1293-1296, edited by J.L. Duggan and I.L. Morgan, AIP Press, New York 1997) in view of Lidsky (US 5,784,423) (previously made of record, see PTO-892 mailed 3/6/2000).

Blackburn et al teach a method for cooling a low-Z target material (title, abstract, and Introduction; such as Be or Li; more specifically Be) of a neutron source assembly (loc.cit.), comprising:

providing, by using a nozzle (second paragraph of section "Submerged Jet Impingement Cooling" on page 1293), a submerged jet of coolant (water) in a direction normal to a non-bombarded surface of the low-Z target material within the neutron source assembly to cool the low-Z target material (back-surface of the target housing: see "Target Cooling System Design" p. 1294, second column; also, see the abstract);

providing a reservoir of coolant (inherent in the "closed chilled-water system", see "Target Cooling System Design", p. 1294, second column); and

pumping the coolant serially from the reservoir through the nozzle such that the coolant impinges upon the low-Z target material in the neutron assembly and cools the target material (see "Submerged Jet Impingement Cooling" section, pp. 1293-1294), from the neutron source assembly to a heat exchanger (inherently existing because the coolant is "chilled") to remove heat from the coolant, and to the reservoir. No other parts intervene but for the inherently necessary pumping system in the presence of the claimed pumping (system including the pumping system shown in Figure 2).

Blackburn et al do not teach (a) the limitation that the liquid coolant be <u>liquid gallium</u>, instead teaching water as coolant, nor (b) do Blackburn specifically teach that the liquid coolant is pumped from the neutron source assembly <u>directly</u> to a heat exchanger <u>and</u> <u>from the heat exchanger to the reservoir</u>.

However, (a) it would have been obvious to include said limitation ad (a) in view of Lidsky, who, in a patent on radioisotope production with cooling of a target (converter 14 or its plates 22) undergoing nuclear reactions, hence art analogous to Blackburn et al, teaches *ex aequo* the selections of water or liquid gallium as coolant (col. 7, l. 10-20). One of ordinary skill in the art of target cooling would deem it obvious to select liquid gallium over water considering its higher thermal conductivity, from which *motivation* derives to combine the teaching of liquid gallium as coolant with the invention by Blackburn et al. *Combination* of the teaching and the invention is straightforward because the only change needed for its implementation is the replacement of water by liquid gallium.

Furthermore, it would at least have been obvious to include said limitation ad (b) in view of Lidsky 's teaching of heat removal means by typical means, such as through coolant channels 26 and through converter inlet 28 and converter outlet 30 (col. 6, l. 62 – col. 7, l. 20), i.e., comprising a heat exchanger downstream and as close to the neutron source assembly as possible, i.e., outlet 30. Hence, from Lidsky one of ordinary skill would consider it obvious that the liquid coolant be pumped from said neutron source assembly directly to the heat exchanger to remove heat therefrom and from the heat exchanger to the reservoir, said reservoir being necessarily downstream of the outlet 30 in the combination. Significant heat exchange capability of an outlet is an obvious advantage because, as one of ordinary skill would understand, the very function of the liquid coolant is to remove heat as fast as possible.

On claim 4: the target material comprises beryllium (see "Introduction", p. 1293, first column, and abstract).

On claim 5: Blackburn et al teach a neutron source assembly (title, abstract) having a liquid cooled target (Be, cooled by water) (for beryllium target see abstract and Introduction, and for water cooled target see title, abstract), comprising:

an accelerator based neutron source (beryllium target for the production of neutrons: see title) including a low-Z target material (beryllium (Be)) (abstract and Introduction) that is bombarded by accelerated particles to produce a neutron flux (said particles being either protons or deuterons; see Introduction); and

a cooling system to circulate (i.e., capable of circulating) liquid coolant (water) in through said accelerator based neutron source to cool the low-Z target material (see the section on "Target Cooling System Design", p. 1294);

said cooling system including a nozzle (see p. 1294, second column), said nozzle providing a submerged jet of liquid coolant (water) in a direction normal to a non-bombarded surface of the low-Z target material (normal direction because, as explained in the section :"Submerged Jet Impingement Cooling", especially on p. 1293, the submerged jet impingement involves the injection of an axisymmetric flow of fluid by means of a nozzle through a region of the same fluid at rest above the target; the jet entraining fluid from the stationary body as it strikes the target surface, the jet spreading out radially away from the area of impact (the stagnation point)) [N.B.: Also note that the liquid coolant (water) is provided to the back-surface of the target (see abstract)];

said cooling system further includes:

a reservoir of liquid coolant (met by “chilled water system which provides cooled, de-ionized water” (p. 1294));

a heat exchanger (met by “cooling system to keep reservoir at a constant temperature”, but also by the “return line” connecting the neutron source assembly and the reservoir, because hot liquid inherently exchanges heat with the environment when pumped from a heat source (the neutron source assembly) to a colder environment: see Figure 2); and

means for serially circulating said liquid gallium from said reservoir through said nozzle to impinge upon said surface of the low-Z target material within said accelerator based neutron source, from said accelerator based neutron source to said heat exchanger (through a “return line” in Fig. 2), and to said reservoir.

Blackburn et al do not teach (a) the limitation that the liquid coolant be liquid gallium, instead teaching water as coolant, nor do Blackburn et al specifically state (b) that the liquid coolant is pumped from the neutron source assembly directly to a heat exchanger and from the heat exchanger to the reservoir.

However, (a) it would have been obvious to include said limitation ad (a) in view of Lidsky, who, in a patent on radioisotope production with cooling of a target (converter 14 or its plates 22) undergoing nuclear reactions, hence art analogous to Blackburn et al, teaches *ex aequo* the selections of water or liquid gallium as coolant (col. 7, l. 10-20). One of ordinary skill in the art of target cooling would deem it obvious to select liquid gallium over water considering its higher thermal conductivity, from which *motivation* derives to combine the teaching of liquid gallium as coolant with the invention

by Blackburn et al. *Combination* of the teaching and the invention is straightforward because the only change needed for its implementation is the replacement of water by liquid gallium.

Furthermore, it would have been obvious to include said limitation ad (b) in view of Lidsky 's teaching of heat removal means by typical means, such as through coolant channels 26 and through converter inlet 28 and converter outlet 30 (col. 6, l. 62 – col. 7, l. 20), i.e., comprising a heat exchanger downstream and as close to the neutron source assembly as possible, i.e., outlet 30. Hence, from Lidsky one of ordinary skill would consider it obvious that the liquid coolant be pumped from said neutron source through an outlet with significant heat exchange capacity so that the liquid coolant be pumped from the neutron source assembly <u>directly</u> to the heat exchanger to remove heat therefrom and from the heat exchanger to the reservoir, said reservoir being necessarily downstream of the outlet 30 in the combination. Significant heat exchange capability of an outlet is an obvious advantage because, as one of ordinary skill would understand, the very function of the liquid coolant is to remove heat as fast as possible.

On claim 7: said means for circulating comprises a pump.

On claim 8: *Blackburn et al teach* a liquid cooling system for a neutron assembly, said cooling system comprising:

a reservoir of liquid coolant (met by “chilled water system which provides cooled, de-ionized water” (p. 1294));

a heat exchanger (comprising “cooling system to keep reservoir at a constant temperature” but also the “return line” connecting the neutron source assembly and the reservoir: see Figure 2); and

means for serially circulating said liquid gallium from said reservoir through said nozzle to impinge upon said surface of the low-Z target material within said accelerator based neutron source, from said accelerator based neutron source to said heat exchanger (see “return line” in Fig. 2), and to said reservoir.

Blackburn et al do not teach (a) the limitation that the liquid coolant be liquid gallium, instead teaching water as coolant, nor do Blackburn et al specifically state (b) that the liquid coolant is pumped from the neutron source assembly directly to a heat exchanger and from the heat exchanger to the reservoir.

However, (a) it would have been obvious to include said limitation ad (a) in view of Lidsky, who, in a patent on radioisotope production with cooling of a target (converter 14 or its plates 22) undergoing nuclear reactions, hence art analogous to Blackburn et al, teaches *ex aequo* the selections of water or liquid gallium as coolant (col. 7, l. 10-20). One of ordinary skill in the art of target cooling would deem it obvious to select liquid gallium over water considering its higher thermal conductivity, from which *motivation* derives to combine the teaching of liquid gallium as coolant with the invention by Blackburn et al. *Combination* of the teaching and the invention is straightforward because the only change needed for its implementation is the replacement of water by liquid gallium.

Furthermore, it would at least have been obvious to include said limitation ad (b) in view of Lidsky's teaching of heat removal means by typical means, such as through coolant channels 26 and through converter inlet 28 and converter outlet 30 (col. 6, l. 62 – col. 7, l. 20), i.e., comprising a heat exchanger downstream and as close to the neutron source assembly as possible, i.e., outlet 30. Hence, from Lidsky one of ordinary skill would consider it obvious to include an outlet from the neutron source assembly with significant heat exchange capacity, so that the liquid coolant be pumped from said neutron source assembly directly to the heat exchanger to remove heat therefrom and from the heat exchanger to the reservoir, said reservoir being necessarily downstream of the outlet 30 in the combination. Significant heat exchange capability of an outlet is an obvious advantage in Blackburn et al because, as one of ordinary skill would understand, the very function of the liquid coolant is to remove heat as fast as possible.

Response to Arguments

3. Applicant's arguments filed 8/11/2010 have been fully considered but they are not persuasive.

Applicant argues that Blackburn et al do not teach a heat exchanger "in serial" with a reservoir. Examiner did not state otherwise. See prior Office action, page 4.

Applicant also argues that Lidsky et al fails to teach or suggest a heat exchanger in serial with a reservoir and moreover do not teach or suggest a heat exchanger in serial with a reservoir and/or circulation of coolant through a heat exchanger before it returns to the reservoir. Examiner did not state otherwise. However, examiner states

and maintains that Lidsky et al teach a heat exchanger downstream and as close to the converter 14, i.e., to the object to be cooled, with reference to col. 6, l. 62 - col. 7, l. 20 in Lidsky et al, as possible, in the form of heat removal means 30 (which is an outlet from the converter 14), said passage in Lidsky et al featuring also that said coolant is re-circulated by force, i.e., pumped, directly and serially from said object to be cooled (14) to said heat exchanger, without any other object in between, - see Figure 3, i.e., meeting the limitation "directly" as stated by the Honorable Board, i.e., with "nothing or no one in between". It is *this* that has to be learned from Lidsky et al, which the Honorable Board has not had an opportunity to consider, and which is an obviousness argument supplementing a reference, Blackburn et al, made of record by Examiner upon the prior Office action, which the Honorable Board has also not had an opportunity to consider. When so supplementing Blackburn et al, the combination of Blackburn et al with Lidsky et al would result in a heat exchanger separate but maximally close to the object to be cooled (outlet 30 being maximally close to the converter 14, because the outlet is the outlet from the converter, and for this reason, downstream thereof) and with nothing in between said heat exchanger and said object to be cooled. It is noted that Lidsky et al disclose that heat removal is provided by typical means "disposed around and / or through convertor 14" (see cited portions in the prior office action, especially col. 6, l. 62-66), and hence to Lidsky et al the distance between target (in their case the converter 14) and heat exchanger is not limited at all from below.

Furthermore, nothing in the disclosure of applicant gives the slightest indication on why and how, or even whether, the limitation "directly", and whether the invention as

otherwise defined by the combination of Blackburn et al and Lidsky et al, is critical to the invention.

Modification of Blackburn et al following Lidsky et al supplements the heat exchange means with a heat exchanger directly downstream from the target (in Blackburn et al), resulting in the liquid coolant to be pumped from the object to be cooled directly to a heat exchanger; and from the heat exchanger to the reservoir. Even arguendo outlet 30 as heat exchanger, nothing would otherwise have prevented the identification of heat exchanger 32A in Lidsky et al, which in no way differs from the disclosure of heat exchanger by applicant as directly serially downstream from the object to be cooled.

For the above reasons the rejections under 35 U.S.C. 103(a) of record are maintained and reproduced above without any change intended.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHANNES P. MONDT whose telephone number is (571)272-1919. The examiner can normally be reached on 8:00 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JOHANNES P MONDT/
Primary Examiner, Art Unit 3663 October 15, 2010